DOCUMENT RESUME

ED 362 695 CE 064 712

TITLE	Austin ISD. Integrated Lesson Plans.
INSTITUTION	East Texas State Univ., Commerce. Educational Development and Training Center.
SPONS AGENCY	Texas Education Agency, Austin.
PUB DATE	92
NOTE	51p.; For related documents, see CE 064 713-715.
AVAILABLE FROM	Educational Development and Training Center, East Texas State University, Commerce, TX 75429 (order no. INT-104-LP: $5).
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Academic Education; Behavioral Objectives; Communications; Competence; Competency Based Education; Curriculum Guides; Electronics; *Integrated Curriculum; *Interdisciplinary Approach; *Learning Activities; Lesson Plans; Mathematical Applications; Science Instruction; Secondary Education; Teaching Methods; *Vocational Education; Writing Instruction

ABSTRACT

This packet contains 14 lesson plans for integrated academic and vocational education courses. Lesson plans for the following courses are included: integrated physics and principles of technology; algebra and principles of technology; principles of technology, language arts, and economics; physics and industrial electronics; physics and microcomputer applications; algebra and microcomputer applications; electronics and algebra; algebra and manufacturing systems; language arts and microcomputer applications; economics and microcomputer applications; and government, language arts, and microcomputer applications. Some of the topics covered are as follows: power of a flywheel, determining the slope of a line, governing engine speed, sources of electricity, graphing data, functions, scientific notation, fractions applied to the design of a prototype, direct and inverse variation, electronic components for building a radio, writing business letters, stock market analysis by graphs or charts, selecting a store location, and producing effective campaign communications. Lesson plans consist of lesson objectives, competencies, teaching aids, materials needed, activities, presentation, application, tests, and (sometimes) extension activities and references. A lesson plan matrix showing lesson topic integration for each course is included in the packet. (KC)

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ED 362 695

Integrated Lesson Plans

Austin ISD

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CE 064 712

AUSTIN INDEPENDENT SCHOOL DISTRICT
EDTC Integration Project - Lesson Plan Matrix

COURSE	LESSON TOPIC	LESSON TOPIC	LESSON TOPIC	LESSON TOPIC	LESSON TOPIC	LESSON TOPIC
SCIENCE	(2) Source of Electricity E	(1) Efficiency of the Fly Wheel S	(2) Graph Data Stopping Distance S	(2) Components in a Radio E	(2) Electromagnetic Induction E	
MATH	(2) Direct/indirect Proportion E	(2) Slope of a Line PT	(2) Scientific Notation E	(2) Introduction to Functions O	(2) Applications of Fractions to Prototype Design TE	
LANGUAGE ARTS	(3) Store Placement O-SS	(3) Governing Engine Speed SS-PT	(3) Campaign SS-O	(2) Writing Business Letters O		
SOCIAL STUDIES	(2) Stock Market O	Store Placement O-LA	Governing Engine Speed LA-PT	Campaign O-LA		
ELECTRONICS	Source of Electricity S	Components in a Radio S	Direct/in- direct Proportion M	Scientific Notion M		
TECH ED	Applications of Fractions to Prototype Design M					
PRIN OF TECH	Efficiency of the Fly Wheel S	Slope of a Line M	Governing Engine Speed LA-SS			
OFFICE EDUCATION	Graph Data Stopping Distance S	Introduction to Functions M	Store Placement LA-SS	Campaign LA-SS	Writing Business Letters LA	Stock Market SS

S=Science
O=Office
M=Math
E=Electronics
LA-Language Arts
TE=Technology Ed.
SS=Social Studies
PT=Principles of Technology

Integration: Physics
Principles of Technology

Subject: Power of a flywheel (efficiency)

Objective: The student will be able to calculate the horsepower of a flywheel with a gasoline powered engine in order to understand the relationship between rotary motion, horsepower, and real world applications.

Essential Elements:
Physics (with integration of principles of technology)
(P.T. 1, 2, 4, 6, 9, 10) P. VII B (2-8 and IX C)

SCANS: Competencies:
Interpersonal: A, C
Information: A, B, C
Technology: B

Foundation Skills:
Basic Skills: D, E
Thinking Skills: A, C, D, E, F

Teaching Aids: Overhead projector
TV-VCR.

Materials: 3-dimensional model of a V-8 engine or other internal combustion engine.
Transparency clearly showing the relationship between flywheel, piston, and motor.
Video: Power in Mechanical Systems.

References: *Principles of Technology*, Unit 6, Subunit one, "Power", Teacher Manual. (Center for Occupational Research and Development, Waco, TX and Agency for Instructional Technology, Bloomington, IN)
Modern Physics. 1991, P. 122 (Holt, Rinehart, Winston)
Conceptual Physics. 1992, pp 150-152, (Addison and Wesley)

Preparation:

Review linear power and show a need to know how power relates in a rotary situation.

Show video "Power in Mechanical Systems."

Presentation:

Refer to P.T. Unit 6, Subunit I, Page 15, example 6-D. Explain that the power delivered by the flywheel is not constant; this is due to the variable internal pressure in the cylinder in relation to the position of the piston.

Show the interdependency of force, displacement, work, rate, and power in linear mechanical and rotational mechanical systems.

Application:

See *Modern Physics*, P. 123, Problems 7, 15, 16

Students should discuss the way that energy losses affect the actual output of typical machines.

Students should research past and current methods of reducing losses (i.e. bearings, lubricants, materials, etc.).

Test:

Have students:

List 5 ways to reduce mechanical losses
Calculate the power of a flywheel given the rotational rate and torque
Calculate the effects of adding a lubricant with its subsequent increase in efficiency and power.

Suggested Extension Activities:

Have students tour the mechanical room of their school and have the building operator explain the various functions and applications of the machines needed to heat and cool the school.

Integration: Algebra
Principles of Technology

This lesson plan may be used by the mathematics teacher and/or the principles of technology teacher. It integrates the "hands-on" laboratory of principles of technology into the mathematics lesson on slope of a line and/or accentuates the mathematics in the PT lesson.

Subject: Determining the slope of a line

Objective: Students will be able to determine the spring constant of a spring. Students will be able to determine the slope of a line given two points.

Essential Elements:
Alg IB: III D.E., I
Principles of Technology:

SCANS: Competencies:
Interpersonal: A, B, D, E
Information: A, B, C

Foundation Skills:
All

Teaching aids: Chalkboard
Overhead
Cartesian coordinate board

Materials: Spring test assembly
Set of slotted weights
C-clamp
Ruler
Data sheet
Calculators

References: *Principles of Technology* (Center for Occupational Research and Development, Waco, TX)
Algebra I. Coxford. (Harcourt, Brace, Jovanovich)

Preparation:

Class will discuss places where springs are found and for what purposes they are used. Springs have potential energy, but different springs have different amounts of potential energy. Some springs are difficult to depress and others are easily depressed. Every spring has a constant associated with it which is related to how much force is required to depress it.

Presentation:

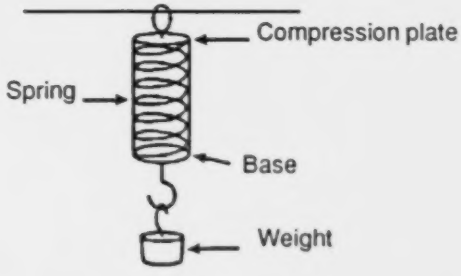
Through performing the following experiment the students will develop an intuitive idea of linear relationships before being presented with the mathematical model. They will experience an application of the slope of a line which represents a physical force.

I. The experiment

Students will have the opportunity to experience an application of the slope of a line which represents a physical force by performing the following experiment. They will develop an intuitive idea of linear relationships before being presented with the mathematical model.

1. Students will be divided into groups of four, and each member of the group will be assigned a specific task. One will be in charge of manipulating the assembly. One will record data on the data sheet. One will use the calculator to do all calculations. One will read the instructions and supervise the activities.

2. Students will assemble the apparatus as shown below. If already assembled, they should examine it to see how it works.



3. With the ruler, measure the height of the spring from the base to the compression plate. Record the height as the initial height on the data sheet.

4. Hang a 50-gram mass on the weight hangar. Record this mass in column one of the data sheet. Multiply the mass by 9.8 and divide by 1000 to obtain the force. Record this answer in column two. Measure the height of the spring from the base to the compression plate. Record the height in column three. Subtract the height in column three from the initial height to obtain the displacement. Record this in column four.

5. Choose four other weights from the set and add them one at a time. Record the total mass. Measure and record the height of the spring for each one. Fill in the chart with force and displacement, as calculated above.

6. When the data chart is complete, plot the compression force versus displacement on the axes. For each ordered pair, the first member is displacement (horizontal axis) and the second is force (vertical axis). EX:

(displacement, force). Plot these points and draw the "best" straight line through the points.

7. Choose two points that lie on the line and determine the coordinates of the points (d1, f1) and (d2, f2).

8. Find the slope of the line using the two points and the formula.

$$\text{Slope} = \frac{f2 - f1}{d2 - d1}$$

9. When all groups have finished, each group should be asked to report their findings. Results should be compared and discussion should conclude which springs are easier to displace and which are more difficult.

II. Discussion

The class should then explore the general formula for slope and some other relationships described by slope.

If (x1, y1) and (x2, y2) are the coordinates to two points on a line, then the slope of the line can be found by the formula

$$\text{Slope} = \frac{y2 - y1}{x2 - x1}$$

Find the slope of the line passing though each pair of points.

a. (5, 3) and (0, 1)

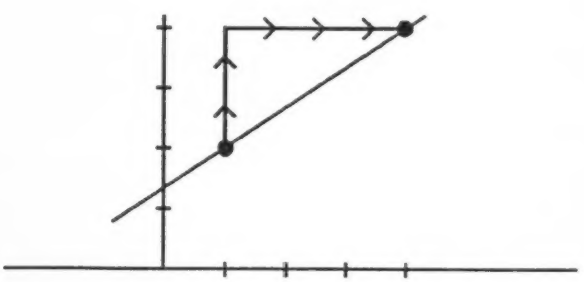
b. (-2, 6) and (7, 5)

c. (0, -5) and (-2, -3)

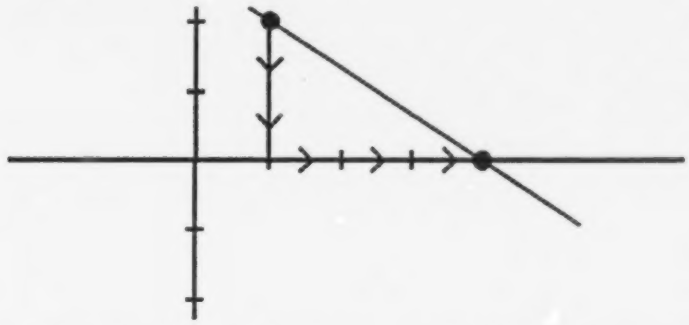
The slope of a line is the ratio of the vertical change to the horizontal change in moving from one point on the line to another or the ratio of the "rise" to the "run".

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

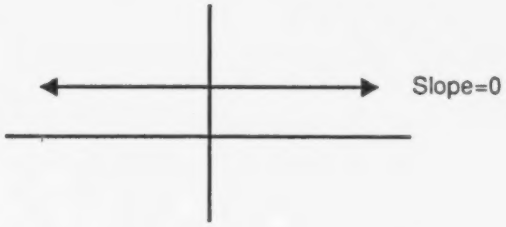
If the point (1, 2) is on the line and the slope is 2/3, then from the point (1, 2) a rise of 2 and a run of 3 brings you to another point of the line.



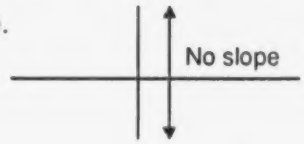
If the slope were -2/3 then a rise of -2 and a run of 3 would bring you to another point on the line.



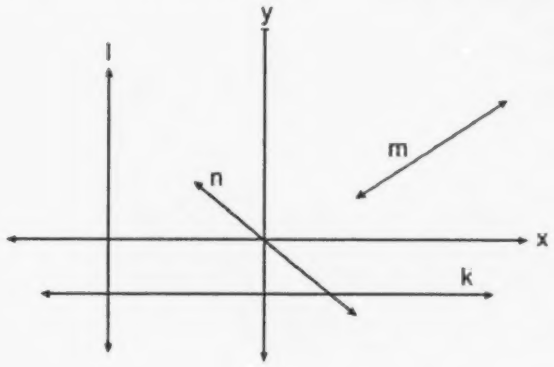
Lines with positive slope rise from left to right. Lines with negative slope fall from left to right. If a line has a slope of zero, then there must be no rise. It would, thus, be a horizontal line.



For vertical line, there is zero run; therefore, slope= $\frac{\text{Rise}}{0}$ which is undefined since we cannot divide by zero. Thus, vertical lines have no slope.



EX:



EX: Which line has a positive slope?
Which has a negative slope?
Zero slope?
No slope?

EX: In a certain state, a $100 sale would cost $5 sales tax and a $300 sale would cost $15 sales tax.
(100, 5) and (300, 15)
Find the slope of the line.
slope =
This slope represents the tax rate.

Ex: In 4 seconds, sound travels 6 km in water. In 6 seconds, it travels 9 km. (4, 6) and (6, 9)
Find the slope of the line.
slope =
This slope represents the velocity of sound in water in km/sec.

Application:
Students should be assigned problems from the book to work independently.

Test:
Ask students to recall the formula for slope

When is the slope positive, negative, zero, undefined?

Recall the springs mentioned at the beginning of the lesson. Which have higher spring constants? Which lower?

If lines were drawn describing force versus displacement, what would the lines look like?

Suggested extension activities:
Students may try to think of other ratios which may be slopes of lines.

Data Sheet

Initial Height = _____

	Mass	Force 9.8 x mass 1000	Height of spring (in meters)	Displacement initial height-height (in meters)
1.				
2.				
3.				
4.				
5.				

Integration:

Principles of Technology
Language Arts
Economics

Note to Instructors: In order to effectively implement this lesson, special consideration may have to be given to the scheduling of students enrolled in these courses. For example: the teachers from the disciplines affected need to teach their courses during the same period of the day. Students will be rotated from one discipline to the next with each teacher given a specific time allotment to present the data necessary for the completion of all phases of the project. Teachers involved will decide on the total time to be devoted to the project.

Subject:

Governing engine speed: force in mechanical systems as it applies to automobile speed

Objective:

Students will study the concepts of force in mechanical systems

Students will consider the question of whether or not automobile speed should be regulated by our government and the existing laws of socially accepted highway speeds.

Students will debate the results of their findings (Language Arts

Essential Elements:
Language Arts: 2E
Economics: 2A

SCANS:

Competencies:
- Interpersonal: A, D, E, F
- Information: A, B, C,
- Systems: C
- Technology: B

Foundation Skills:
- Basic Skills: C, D, E
- Thinking Skills: A, B, C, F
- Personal Qualities: A, C, E

Teaching Aids:

Library facilities
Resource speaker on the law and motor vehicles

Materials:

Lab measuring equipment: metric and English rulers, protractors, and scales

Principles of Technology Film on Unit One: Force

References:

Principles of Technology, (Center for Occupational Research and Development, Waco, TX and Agency for Instructional Technology, Bloomington, IN.)

Preparation:
As each teacher begins his/her presentation of the unit the students will be informed that three subject areas (principles of technology, economics, and language arts) will be involved with this project.

Presentation:

Application:

A. Economics

1. teacher presentation on the role of government regulation in the economy
2. guest speaker will give lecture on the law and motor vehicles

B. Principle of Technology

1. view film on force
2. perform experiments involving force

C. Language Arts

1. using the information acquired in economics and principles of technology students prepare arguments expressing their views on government regulation of automobile speed.
2. students will present their ideas in the form of a debate

Note to teacher - The application will be introduced after students have completed a rotation of the three discipline areas. It is each teacher's responsibility to cover the material needed for students to successfully complete this assignment. Each teacher will introduce the application and organize student groups in his/her respective class.

Test:
Each teacher will evaluate students in his/her own discipline using standard evaluating procedures.

Integration: Physics
Industrial Electronics

Subject: Sources of electricity

Objective: The student will be able to list three methods of converting chemical energy to electrical energy and list four additional ways of producing electrical energy.

Essential Elements:
- Industrial Electronics: (o) (1, 2, 3)
- Physics: VI A

SCANS: Competencies:
- Interpersonal: A, B
- Information: A, B, C
- Technology: B

Foundation Skills:
- Basic Skills: D, E
- Thinking Skills: A, C, D, E, F

Teaching Aids: Blackboard
Overhead projector

Materials: Transparencies
Thermocouple
6 volt battery
Solar cell (use a solar powered calculator)
Genecon generator.

References: *Electricity and Electronics* (Gerrish and Dugger)
Modern Physics (Holt, Rinehart, and Winston)

Preparation:

This lesson will show you how physics can be applied to electronics. How many sources of electricity are there? What is the source for the lights in this room? What provides the power for your Walkman? Can sunlight be used to provide electricity? You will learn about the different sources of electricity which are chemical, mechanical, thermoelectric, and photoelectric.

Presentation:

Instructional Topic	Key Points (things to say and do)
A. Conversion of Chemical Energy:	
1. Voltaic Cells.	A chemical reaction produces opposite charges on two dissimilar metals, which serve as the positive and negative terminals.
a. Lead acid cell. Each cell is 1.5 volts.	Used in cars. Can be recharged by reversing the current flow. Car batteries are made up of six cells.
b. Carbonized zinc dry cell. Each cell is 1.5 volts.	Carbon rod (positive terminal) inserted into an ammonium chloride and zinc chloride paste which is contained in a zinc can (negative terminal). A 9 volt battery has 6 cells in series. Cannot be recharged.
c. Lithium cell. Each cell is 2.9 or 3.7 volts.	Provides 10 times more energy than carbon zinc with 5 times the service life. Used as the DC power source for a cardiac pacemaker.
d. Nickle-Cadmium (NiCd) cell. Each cell is 1.25 volts.	Delivers a high current and can be recharged a 1000 times. Used for portable tools, rechargeable flash lights, and alarm systems.
B. Photoelectricity.	Some materials emit electrons when light strikes the surface. The element silicon is used.
Solar cells. .5 volts per cell.	Converts the sun's light energy directly into electrical energy. Has many uses: satellite power, calculators, recharge farm equipment while in the field, highway emergency warning signs.
C. Thermoelectric.	Electricity produced by heat.
Thermocouple. Produces .001 volts.	Two dissimilar metals joined together and when heated produces a very small voltage. Used in gas dryers, heaters, and ovens as a safety device. When the pilot light is lit, the thermocouple sends a voltage to the gas valve. If the pilot goes out, gas cannot flow.

D. Electromagnetism.	Electricity and magnetism are closely related. Any moving charge has an associated magnetic field. Any changing magnetic field can produce electricity.
E. Generator. Produces high voltages.	Converts mechanical energy to electrical energy. Produces voltage by means of a conductor rotating in a magnetic field. This method is used to produce more than 95% of the electricity used in the world.

Applications:

A. Form groups of five students and assign each group a source of electricity. Have them discuss uses for the assigned topic, record the results, and report to the class.

B. Have the students brainstorm other sources of electricity not discussed. Examples are friction and piezoelectric effect.

Test:

1. List three methods of converting chemical energy to electrical energy.

2. Complete each sentence with a term from the list on the right

2.	A _____ is a chemical source of electricity made up of two dissimilar metals placed in an acid solution.	a. voltaic cell
3.	A _____ device is a material such as silicon that generates a voltage when subjected to light.	b. solar cell
4.	A _____ consists of two dissimilar metals joined at a junction. When heated it provides a very small voltage.	c. thermo couple
5.	A _____ is a machine that converts mechanical energy to electrical energy.	d. generator

Suggested Extension Activities:

A. Examine an assortment of dry cell batteries and discuss what effects the physical size has on voltage and current capacity.

B. With a bar magnet, coil, and voltmeter, demonstrate the effects of moving the magnet while the coil is stationary. Also hold the magnet stationary and move the coil.

Integration: Physics
Microcomputer Applications

Note to Instructors: In order to effectively implement this lesson, special consideration may have to be given to the scheduling of students enrolled in these courses. For example: the teachers from the disciplines affected need to teach their courses during the same period of the day. Students will be rotated from one discipline to the other with each teacher given a specific time allotment to present the data. Teachers involved will decide on the total time to be devoted to the project.

Subject: Graph data stopping distance

Objectives: The student will be able to graph data points.

The student will be able to utilize a word processing software package to address written assignments.

The student will be able to recognize the great distances needed for stopping an automobile--especially at high speeds.

Have students intuitively estimate the distances required to stop an automobile. Use various speeds of 25 mph, 35 mph, etc.

Essential Elements:
Physics: 1C, 1D, 2A, 2C, 3C, 5C
Microcomputer Applications: 2B, 2C

SCANS: Competencies:
- Resources: A, C, D
- Interpersonal: A, D, E
- Information: A, B, C, D
- Technology: A, B, C

Teaching Aids: Overhead projector
Computers

Materials: Software (graphics and word processing)
Transparency
Handout (taken from *Physics* by Zitzewitz and Neff, Glencoe Publishing Co.)

References: Software documentation
Physics (Zitzewitz and Neff, Glencoe)

Preparation:
As each teacher begins his/her presentation of the unit, an explanation will be given to the students regarding a project that will be assigned at the end of the individual units of study. The project will involve the areas of physics and microcomputer applications.

Presentation:

A. Science—The physics teacher will discuss the factors that affect reaction time (i.e. drinking alcohol, weather conditions, poor vision, condition of car, time of day, etc.) and stopping ability while operating a vehicle.

B. Microcomputer Applications—The office education teacher will train the students to use a graphics program given various business applications.

Application:

Students will be given various data relating speed to stopping distances.

Key points to remember:

1. Carefully view all data points.
2. Note conversions from meters per second to miles per hour.

Using a graphics program, the students will take the data discussed in the science class and plot the speed v.s. the distance. The final graph should be like Figure 2-11 on the handout. (Note that the graph in the handout includes the reaction distance, breaking distance, and total distance.)

Using a word processing software package, the students will answer questions pertaining to the results of the printout. (i.e. What is the total stopping distances at 50 mph and at 75 mph?)

Test:

The grade will be based on the successful completion of the graph and correct analysis to answer the questions.

Integration: Algebra
Microcomputer
This lesson plan integrates the application of computer software designed to produce graphs into the mathematics classroom.

Subject: Introduction to functions

Objectives: Students will understand the definition of "function" and will be able to demonstrate functions using graphs.
Students will be able to answer questions about the function using the graphs.
Essential Elements:
Algebra IB: III A, B
Microcomputer: 5(c), 4(c)

SCANS: Foundation Skills:
Basic Skills: A, B, C, D
Thinking Skills: A, B, C, F
Personal Qualities: A, B, C, D, E

Teacher Aids: Overhead/chalkboard
Overhead computer screen
Computer and graphing software
Computers

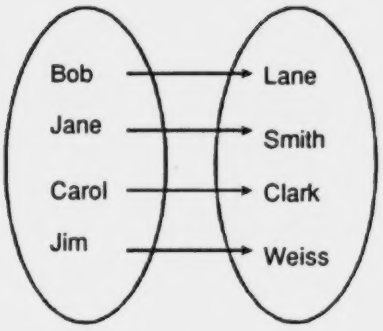
Materials: Lab sheets

Reference: Software documentation for Graphing Assistant
IBM
Algebra: Structure and Method, Book I (Houghton-Mifflin)

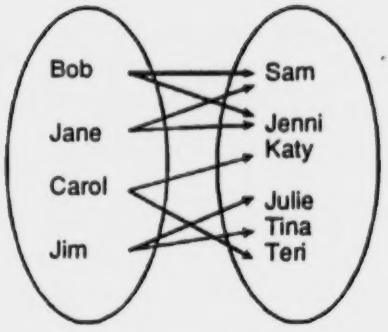
Preparation:
Students will be given examples of functions and will brainstorm others.

EX: Girls are usually approximately 1/2 inch taller than their mothers.
Salaries are generally higher for people who have more education.
Grades are generally lower for people who spend more time watching TV.
Sales are usually higher when prices are lower.
How far you travel in a given time depends on how fast you are going.
Volume of a box depends on the dimensions of the box.

Presentation:
The teacher will define "function" and illustrate as a correspondence and as a set of ordered pairs.



Function



Not a Function

{(Bob, Lane), (Jane, Smith), (Carol, Clark), (Jim, Weiss)}

The domain and the range will be defined and listed for each example.

The class will return to the list produced in the brainstorming session and determine which are functions according to definition, which are not, and if not, why not:

Graphs and charts are very often used to illustrate functions. Graphs may be bar graphs, line graphs, or pie charts.

As an example, the class will together develop a table of values for any one of the functions noted above. For example, if you drive for 2 hours.

at a rate of:	you will travel:
20 mph	40 mi
30 mph	60 mi
40 mph	80 mi
60 mph	120 mi

The teacher will then demonstrate the use of the computer software on the overhead by graphing the table of values.

Together the class should answer some questions which can be answered from the graph. These questions might include:

1. What is the domain of the function?
2. What is the range?
3. Estimate from the graph the distance traveled at 25 mph.
4. Estimate the distance traveled at 90 mph.
5. What would the graph look like if there were 2 values of the range for one particular value in the domain (i.e. if it were not a function)?

Students will be divided into pairs to use the graphing software to illustrate the functions defined on the lab sheet (attached) and/or the original functions produced in the brainstorming session.

Note: The lab sheet is written to conform to Graphing Assistant by IBM; however, any graphing software could be used.

Application:

Students will be asked to bring 2 graphs from newspapers or magazines. Determine whether each represents a function or not. If so, what function? If not, why not? Write and answer at least three questions about each graph. Questions may not be repeated.

Graphs are usually informative but are sometimes persuasive. Are any of the student examples persuasive? In what way?

Test:

Evaluation will be based on student work in class and on work done at home.

Steps Used To Create A Graph

(The following steps will correlate Graphing Assistant.)

1. Load DOS in the A Drive.
2. At the A> take the DOS disk out of the drive and put in the Graphing Assistant disk.
3. At the A> type GA and "enter".
4. At the main menu select option 1 "Enter or Edit".
5. The cursor will now be at the X-Data Format screen. (To obtain a listing of the various x-data formats, press F9. Please note that any x-data entered in as number may only produce a line chart.) The type of data to be entered on the horizontal axis (X-axis) for example 1 will be identified as a label. At the X Data Format press "1" and enter.
6. The cursor is now in the X-data field and is ready for data to be entered.
   Type Jog and tab to Graph A, type 210 and press enter,
   Type Swim and tab to Graph A, type 270 and press enter,
   Type Tennis, tab, type 210, press enter
   Type Walk, tab, type 120, press enter
   Type Bicycle, tab, type 330, press enter
7. Press F10 to accept the data. The Main Menu will appear and the data is in temporary storage in working copy. It has not yet been saved on the work diskette.
8. At the main menu select option 2, "Define Chart". Three selections will be present. Select option 1, "Types and Legends".
9. We are working with Graph A. Tab to the "Type" column and notice that Bar is already present. (If we wanted to change the type, we would type in the type of chart desired.)
10. Press F10 to accept any changes.
11. Press ESC to return to the Main Menu.
12. To print, select option 3 "Print or Plot". Select the size of the graph (either large or small). Then, decide whether to print out the data points. (Data points will be other reference points used to create the graph).
13. Press F10 to accept any changes.
14. Position paper in printer (as per the prompt). and type "Y" to begin the printing process.

Example 2:

1. Type 7 to clear the screen for the next graph to be created.
2. In this example, you will be entering numbers in the x-data field. Therefore, at the X-Data Format, press "N". The data follow:
   In the X-data field type 1940, tab to Graph A, type .30 and "enter".
   Type 1950, tab, type .60, enter.
   Type 1960, tab, type 1.25, enter.
   Type 1970, tab, type 2.00, enter.
   Type 1980, tab, type 3.25, enter.
   Type 1990, tab, type 5.00, enter.
3. Press F10 to accept all changes.
4. At the main menu, select option 2, "Define Charts". Again, choose "Types and Legends". Change the type of chart from bar to line. Press F10 to accept the changes.
5. Print the graph, choosing whether to print a large graph or a small one and whether to print the data points or not.
   Answer the following questions about each of the graphs you did in #1-5.

1. Name the graph.
2. Does the graph illustrate a function?
3. Name the domain and the range of the function.
4. Write and answer 2 questions about the data in the graph.
5. Does the graph seem to be more informative than a list of ordered pairs? Why?

Integration: Electronics
Algebra

This lesson plan may be used by the mathematics teacher and/or by the electronics teacher. It integrates the vocabulary of electronics into the mathematics lesson on scientific notation and/or integrates the mathematical theory of scientific notation into the electronics classroom.

Subject: Scientific Notation

Objectives: The student will be able to convert numbers from decimal notation to scientific notation.

The student will understand and be able to use the metric prefixes.

Essential Elements:
Electronics: (O)(1), (A)(7)(B)
Algebra I: VI-G]

SCANS: Foundation Skills:

Students will be able to perform basic mathematical computations.

Students will be able to choose an appropriate and practical method to represent very large or very small numbers.

Students will be able to use the calculator to solve problems involving very large or very small numbers.

Teaching Aids: Overhead/Chalkboard
Calculators

Materials: Application Worksheet

References: *Industrial Electronics* (University of Texas at Austin, Division of Continuing Education)

Algebra Structure and Method, Book I (Houghton Mifflin)

Preparation:

In this lesson, students will learn to use scientific notation to assist in dealing with very small or very large numbers. Many examples of these numbers may be found in the field of science. On the day before this lesson, students may be assigned the task of looking up some very large or very small numbers. A few examples are the distance from earth to any planet, the distance from earth to the sun, the amount of the national debt, Avogadro's number, the diameter of an atom of helium, etc.

The field of electronics is filled with natural examples of large and small numbers since we deal with electricity in both large amounts (power generated for cities) and small amounts (power required for operation of watches). The metric prefixes are commonly used in electronics to deal with large and small quantities. In this lesson students will

also learn to use metric prefixes to more appropriately deal with large and small quantities.

Presentation:

Have students dictate numbers. Each student should give a number larger than the previous student's. Continue until numbers are in the billions. (You may have students multiply the previous number by 100 if the progression does not increase rapidly enough.) All numbers should be written on the board.

Students should report numbers which they looked up the previous night. These numbers should also be written on the board. (Some of these may be already written in scientific notation).

Large numbers like these can be confusing with all those zeroes, so scientists and mathematicians invented a new way to write them which is less confusing. It is called scientific notation. Scientific notation uses the product of two factors to represent a very large or very small number. The first factor is a number between 1 and 10, and the second is a power of 10.

For example, the number 93,000,000

may be written as 9.3×10^7

number between 1 and 10 — power of 10

Note that the exponent of 10 tells you how many decimal places to move the decimal to the right.

EX:

$5.47 \times 10^3 = 5470$

$4.31 \times 10^5 = 431000$

$5{,}680{,}000{,}000 = 5.68 \times 109$

$6{,}340{,}00 = 6.34 \times 106$

What do you suppose it would mean if the power of 10 were negative?

EX:

$5.47 \times 10^{-3} = .00631$

$4.8 \times 10^{-7} = .00000048$

$.0000000009 = 9.00 \times 10^{-10}$

This is a short way to write numbers that are very small.

Try to multiply these numbers on your calculator.

158,000,000 X 36,000

What happens? What answer do you get? Can you read it? What do you suppose that it means? How many digits will fit into the output screen of your calculator?

It is particularly handy to write numbers in scientific notation if the numbers are to be added, subtracted, multiplied, or divided.

Multiplication/Division

Recall that $10^3 \times 10^5 = (10x10x10) \times (10x10x10x10x10)$

$= 10x10x10x10x10x10x10x10$

$= 10^8$

When the bases are the same, you add the exponents.

Now, for example,

$534{,}000{,}000 \times 28{,}700$

$= (5.34 \times 10^8) \times (2.87 \times 10^4)$

$= 5.34 \times 2.87 \times 10^8 \times 10^4$

$= 15.3258 \times 10^{12}$

$= 1.53258 \times 10^{13}$

$15300/150$

$= \dfrac{(1.53 \times 104)}{(1.5 \times 10^2)}$

$= 1.02 \times 10^2$

Addition/Subtration

In order to add and/or subtract numbers in scientific notation, the powers of 10 must be equal.

For example,

$(4.56 \times 10^{-3}) + (3.65 \times 10^2)$

$= (45.6 \times 10^2) + (3.65 \times 10^2)$

$= (45.6 + 3.65) \times 10^2$

$= 49.25 \times 10^2$

$= 4.925 \times 10^3$

$(7.63 \times 10^5) - (5.11 \times 10^3)$

$= (763. \times 10^3) - (5.11 \times 10^3)$

$= (763. - 5.11) \times 10^3$

$= 757.89 \times 10^3$

$= 7.5789 \times 10^5$

Students may be given a few exercises similar to these to practice in class while the teacher checks understanding and provides corrective feedback.

Another easy way to indicate very large or very small quantites in the metric system is to indicate powers of ten with a prefix. For example, we are already familiar with meters and kilometers. Kilo means 1000, so kilometers means 1000 meters or 10^3 meters.

5.67 kilometers = 5.67 X 10^3 meters
70.9 kilohertz = 70.9 X 10^3 hertz
(hertz is a measure of frequency)

Some other prefixes are

tera = 10^{12}
giga = 10^9
mega = 10^6
kilo = 10^3
milli = 10^{-3}
micro = 10^{-6}
nano = 10^{-9}
pico = 10^{-12}

EX: 33.5 millivolts = 33.5 10^{-3} volts
= .0335 volts

(volts is a measure of voltage)

.005 megggaohms = .005 x 10^6 ohms
= 5000 ohms

(ohms is a measure of resistance)

15.3 gigawatts = 15.3 x 10^9 watts
= 15300000000 wats
(watts is a measure of power)

Evaluation:
Have students do a few of these exercises in class. Call out answers. Check with each other.

Suggested Extension Activities:
Students may wish to suggest other large or small numbers which they find.

Student may invent a mnemonic device for learning the metric prefixes.

Students will do the problems on the application worksheet.

Application Worksheet

Name _____ Date _____

Direction: Perform the following operations and round off your answers to three significant figures. Answers that are to be written in scientific notation, i.e. should be written as a number between 1 and 10 times a power of ten.

A. Convert to scientific notation:

1. 142.53 = _____
2. 1,500,000 = _____
3. 0.00336 = _____
4. 4,663,310.56 = _____
5. 86,400 = _____
6. 0.12500 = _____
7. 0.00125 = _____
8. 0.000000000000144 = _____
9. 65,500,000,000,000 = _____
10. 0.000006835 = _____

B. Convert to standard notation:

11. $1.63 \times 10^{7} =$ _____
12. $4{,}781354 \times 10^{3} =$ _____
13. $1.01 \times 10^{6} =$ _____
14. $9.81 \times 10^{1} =$ _____
15. $3.11445 \times 10^{-4} =$ _____
16. $6.5545 \times 10^{12} =$ _____
17. 8.001 X 10-5 = _____
18. $9.34512 \times 10^{-6} =$ _____
19. $6.28 \times 10^{6} =$ _____
20. $3.14114 \times 10^{0} =$ _____

C. Solve the following:

21. $(1.60 \times 10^{2}) + (4.40 \times 10^{2}) =$ _____
22. $1.50 \times 10^{2}) + (1.50 \times 10^{3}) =$ _____
23. $(3.20 \times 10^{3}) + (4.00 \times 10^{2}) =$ _____
24. $(3.40 \times 10^{3}) + (2.00 \times 10^{2}) =$ _____
25. $(4.20 \times 10^{2}) - (2.60 \times 10^{2}) =$ _____
26. $(12.50 \times 10^{4}) - (2.5 \times 10^{2}) =$ _____
27. (4.8×10^{-3}) Divided by $(2.4 \times 10^{3}) =$ _____
28. (8×10^{-6}) Divided by $(4 \times 10^{-6}) =$ _____
29. $(1.5 \times 10^{3}) \times (1.5 \times 10^{-3}) =$ _____
30. $(4.2 \times 10^{-4}) \times (60.2 \times 10^{-3}) =$ _____

D. Complete the following chart:

31. 0.34 ampere _____
32. _____ 5×10^{5} ohms
33. 000006 seconds _____
34. _____ 20.5×10^{5} hertz
35. 65,000,000 hertz _____
36. _____ 5×10^{-6} watts
37. 6,000,000 watts _____
38. _____ 2×10^{-9} seconds
39. 58,000 volts _____
40. 5×10^{3} volts _____

E. Make the following conversions:

41. Change 33.7 millivolts to volts. _____
42. Change 3,265 millivolts to volts. _____
43. Change 2.2 microvolts to volts. _____
44. Change 4.29 megawatts to watts. _____
45. Change 50 megahertz to kilohertz. _____
46. Change 19 X 106 ohms to megaohms. _____
47. Change .066625 seconds to milliseconds. _____
48. Change 0.987 nanoseconds to picoseconds. _____
49. Change 4,345 watts to kilowatts. _____
50. Change 1,300 megahertz to hertz. _____

Integration:

Algebra
Manufacturing Systems

This lesson is designed to be used by the mathematics teacher together with the manufacturing systems teacher. It integrates a very real application of fractions into the mathematics classroom. It may be used at the beginning of a unit on operations with fractions or as a termination of the same unit.

Subject:

Application of fractions to the design of a prototype

Objectives:

Students will be able to design a prototype of a VHS tape stand.
Students will be able to determine the bill of materials and cost of the project.
Students will participate in the construction of the prototype.

Essential Elements:

- Algebra: IA: VI A, B, C, D, E
- Manufacturing Systems: 75.85.114, 75.85.120

SCANS:

Competencies:

- Resources: B, C
- Interpersonal: A, D
- Information: A, B, C
- Systems: C
- Technology: A

Foundation skills:

- Basic skills: A, B, C, D, E
- Thinking skills: A-F
- Personal Qualities: A, D

Teaching Aids:

Math: Overhead/chalkboard
Overhead ruler
Example of a design to be used to measure and determine board feet.

Materials:

Math:

- Transparencies
- Rulers
- Pieces of wood
- Calculators

Manufacturing:

- Wood and other materials required for the manufacture of the prototype
- Worksheets HO12-5, HO12-6 (Manufacturing Technology Today and Tomorrow)

References:

Algebra: Structure and Method, Book II, (Houghton-Mifflin)
Manufacturing Technology Today and Tomorrow (Glencoe)

Preparation:

The purpose of mathematics education is to give students the concept of a mathematical model. In this integrated lesson, mathematics will be used to design a useful product which will later be manufactured. Students will share their designs and will be able to either be involved in the manufacture or have access to the finished product. This will give students a real concept of a mathematical model.

Students will use the manufacturing lab facilities to build their prototypes. Consideration will be given to aesthetics, cost and availability of materials, and ease of machining.

When products are completed, the groups will present their products to the class. The class will then consider which one would be most suitable for mass production.

Presentation:

Math

Day 1:

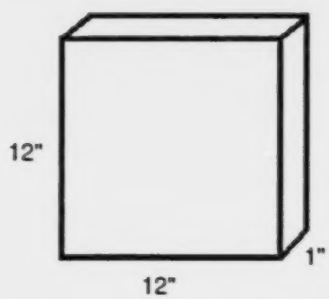
Much of mathematics was invented for the purpose of modeling reality. When engineers design structures, they plan a lot before they begin to build. Their plan is a mathematical model of the real structure. We are going to use mathematics to plan and produce a real item. Today you will do the design.

Divide the class into groups of four students each. Each group will plan and sketch a cabinet to hold 30 VHS tapes. The cabinet will be hung on the wall and will have a separate space for each tape. It must be no larger than 24" X 18". Designs must include measurements.

Sketches will be turned in and evaluated by the teacher at the end of the hour. Examples which are particularly good and those which are inappropriate will be demonstrated to the class.

Day 2:

Students will determine the number of board feet which will be required to build their design. One board foot is the volume of a 12" X 12" X 1" board.



Volume=12x12x1=144

To determine the number of board feet, you find the volume of the wood you will use and divide by 144. To find the volume of wood, since wood is usually rectangular, you multiply length by width by thickness.

For example, use a board here. Measure the length, width, thickness. Demonstrate use of the ruler, fractional parts of an inch, addition and

multiplication of fractions. Determine the volume of the board. Divide by 144 to find the number of board feet.

Have students use rulers to measure scraps of wood, find volume, use calculators to divide by 144, and find board feet. Each group will show their own board and report the number of board feet. Compare answers to determine if answers are feasible.

To determine the number of board feet required before you have actually constructed a product, you use the design.

For example, here the teacher should demonstrate using exemplary design on the overhead.

In a similar manner, students will now determine the number of board feet required for their project. Calculations will be done by each student in each group. Group members will then compare answers and determine correctness.

The design will then be turned in.

Day 3:

Students will calculate total cost of their product. The teacher should investigate and provide students will current prices of various types of wood, wood stains, wood glue, and any other supplies which might be needed according to student designs.

Students will choose the type of wood and other necessary supplies and compute the total cost of the product. They will then present their results to the rest of the class.

Manufacturing Systems:

Students will have already passed machine safety tests prior to construction of prototypes.

Divide students into groups of 3 or 4. Include at least one member of the integrated math class in each group.

Discuss conservation of materials.

Students build prototypes. Each student within group will have a specific task.

After completion of prototypes, a representative of each group will present his product to the class.

Teacher will lead a discussion on factors involved in mass production. (Use worksheets HO12-5 and HO12-6)

Groups will apply production parameters to their prototypes. They will present their findings to the class.

The class will vote on which prototype would be best suited for mass production. Factors to be considered will include but not be limited to: cost, function, aesthetics, and ease of manufacture.

Test:

Evaluation will be done on each presentation and on the daily performance of students.

33

Integration: Algebra
Electronics

This lesson plan may be used by the mathematics teacher and/or by the electronics teacher. It integrates the hands-on electronics laboratory into the mathematics lesson on direct and inverse variation and/or accentuates the mathematics in the electronics lesson.

Subject: Direct and inverse variation

Objective: Students will understand direct and inverse variation and solve problems using direct and inverse variation.

Essential Elements:
Algebra IB: 2E, 3I, 6D, 4A, 4D, 6D
Electronics: 75.88 (A)(7)(B)
75.88 (O)(1)

SCANS: Competencies:
Interpersonal: A, B, D, E
Information: A, B, C

Foundation skills:
All

Teacher Aids: Overhead
Chalkboard
Electrical circuits

Materials: 9 V, 6 V, and 12 V batteries
Digital multimeters
1 K, 2 K, and 3 K ohm resistors
Protoboards
Wire
Transparencies
Lab sheets

References: *Basic Electronics* (Grob, McGraw-Hill)
Algebra I (Harcourt, Brace, Jovanovich)

Preparation:

Students will be given examples of direct and inverse variation and will brainstorm others.

EX: Direct variation: The more you eat, the more you weigh.
The more traffic tickets you get, the more your insurance costs.
Inverse variation: The older your car is, the less it is worth.
The higher your headwind, the slower your speed.

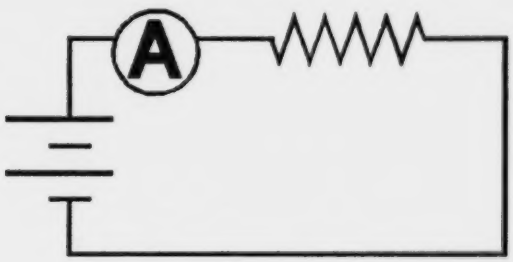
Presentation:

I. Students will now have the opportunity to see examples of direct and inverse variation by performing the lab experiment described below. They will develop an intuitive understanding of what direct and inverse variation are before being presented with the mathematical model.

Laboratory experiment:

1. Students will be divided into groups of 4. One student in each group will be assigned to change components of the electrical circuit. One will be the data transcriber. One will read the meter. One will read instructions and supervise the activity.

2. An electrical circuit (described below) will be given to each group. A 9 V battery and a 2 K-ohm resistor will be used to begin.



3. Students will measure the current by reading the meter and will record the data on the data sheet provided (see the example attached).

4. The battery will be changed to a 6 V and the process repeated. Students will determine whether the voltage and the current have increased or decreased and record their observations on the data sheet. The battery will then be changed to a 12 V and the process repeated again.

5. Students will refer to the data collected and answer the questions regarding what happened and what type of variation was demonstrated.

6. The 9 V battery should be placed into the circuit with the 2 K-ohm resistor and the meter read again. Data should be recorded in the second part of the data sheet.

7. The resistor will now be changed to a 1K-ohm and the measurements taken and recorded. Students will determine whether the current has increased or decreased and will record their observations on the data sheet. The resistor will then be changed to 3 K-ohm and the process repeated.

8. Students will refer to the data collected and answer the questions regarding what happened and what type of variation has been demonstrated.

9. Student should try to write an equation which relates current, voltage, and resistance.

10. When all groups have finished, some should be asked to report their findings. Class discussion should lead to the relationship V=I*R.

II. The class could then explore other relationships which are described by formulas.

EX:	d = r t	How does distance vary as rate?
	r = d/t	How does rate vary as time?
	A = l w	How does area vary as length?

In general, if y varies directly as x, then y = k x where k is the constant of variation. For example, if the interest rate is 6%, then interest = .06 amount in account. Interest varies directly as the amount in the account.

Problem: If y varies directly as x and y=8 when x=3, find k.

y = k x

8 = k 3

8/3 = k

Now that you have found the value of k, you can find the value of y for any given value of x.

Find y when x = 12.

y = 8/3 x

y = (8/3)(12)

y = 32

Students should work more problems with direct variation under the supervision of the teacher at this point.

If y varies inversely as x, then y = k/x.

EX: If several people pitch in to buy a refrigerator which costs $100 for the office, then the amount each one must pay is equal to $100 divide by the number of people who participate.

amt = 100/n

The amount varies inversely as the number of people.

Problem: If y varies inversely as x, and y=5 when x=4, find k.

y = k/x

5 = k/4

20 = k

After finding k, you can find any value of y for a given value of x

Find y when x = 10.

$y = k/x$

$y = 20/10$

$y = 2$

Find y when x = 6.

$y = 20/6$

$y = 10/3$

At this point students should work more problems with inverse variation.

Application:

Students should be assigned problems from the book to work independently.

Test:

Ask students to recall what direct and inverse variation mean.

Go over the list of things which vary directly and inversely which was produced in the brainstorming session at the beginning of the lesson.

Suggested Extension Activities:

Students may think of other things which vary directly or inversely.

Students may try to find the formulas which relate some of the things which have been mentioned.

Data Sheet

Battery	Resistor	Meter Reading (current)	Current increase/decrease
9 V	2 K-ohm		
6 V	2 K-ohm		
12 V	2 K-ohm		

1. When the voltage was decreased from 9 V to 6 V, did the current increase or decrease?

   _____

2. When the voltage was increased from 6 V to 12 V, did the current increase or decrease?

   _____

3. Do voltage and current vary directly or inversely?

   _____

Data Sheet

Battery	Resistor	Meter Reading (current)	Current increase/decrease
9 V	2 K-ohm		
9 V	1 K-ohm		
9 V	3 K-ohm		

4. When the resistance was changed from 2 K-ohm to 1 K-ohm, did the current increase or decrease?

   _____

5. When the resistance was increased from 1 K-ohm to 3 K-ohm, did the current increase or decrease?

   _____

6. Does the current vary inversely or directly as the resistance?

   _____

7. Study the numbers in your data chart and see if you can find the formula which relates voltage, current, and resistance. Write your answer below.

   _____

Integration: Electronics
Physics

Subject: Electronic components for building a radio

Objective: To identify various components and understand their operational characteristics.

The students will study the concept of tolerance and investigate the precision with which they are manufactured.

Essential Elements:

Electronics 75.88 (o)(4)
75.88A(7)(c)
75.88(o)(2)
Physics V.E. VIIIA VIIIE

SCANS: Competencies:

Interpersonal: A, C
Information: A, B, C
Technology: B

Foundation Skills:

Basic Skills: D, E
Thinking Skills: A, C, D, E, F

Teaching Aids: Blackboard
Overhead

Materials: Breadboard
1000 ohm resistor
LED
10 cm wire
9 Volt battery
Diode
Variable capacitor
Crystal earphone
(Optional: voltmeter and O-scope)
Transparencies (Electricity and Electronics Experiment Kit)

References: Electricity and Electronics Experiment Kit (Motorola Inc.)
Note: Acquisition of the experiment kit is necessary for teaching this lesson.

Preparation:

Students will be given a box of electronic components that are used to construct a simple radio. They will identify what they are and what they do.

The teacher will discuss the various manufacturing methods used in the construction of diodes, resistors, capacitors, and inductors.

Presentation:

The students will be introduced to the breadboard which allows us to quickly assemble, test, change, fix, and otherwise experiment with the rest of the devices.

(See overhead #1) Key Points: The vertical columns are electrically connected (A-E). There are no horizontal electrical connections except for rows X and Y.

The students will be shown the chart (see overhead #2) that allows them to calculate the value and the tolerance of the resistor. Key Points: Resistors are the most commonly used component. They control the current and divide the voltage.

EX: -- [: : : :] -- = 1000 ohms -- 5%

B B R G
r l e o
o a d l
w c d
n k

The students will be shown overhead #3 and #4.

The students will see illustrations of Diodes [key point - conducts electricity in only one direction; negative to positive], LEDs [key point - the flat side is negative (short lead)], Capacitors [key point - stores electricity; never touch the leads, the capacitor may discharge; observe polarity with electric capacitors], and transistors [key point - used typically for amplification. Note Emitter, Base, and Collector positions].

While the overheads are shown, the students will inspect each of the components, separate them into different categories, and label those that have measurable values.

Applications:

Once the components have been identified and labeled, students should be allowed to do activity one and two. (See lab experiment sheet and the student activity sheet from Motorola experiment kit.)

Test:

Successful completion of the activity sheets.

Suggested Extension Activities:

A) Try various antennae and various taps on the coil.

B) Use the O-Scope to measure the D.C. voltage.

Integration

Language Arts
Microcomputer Applications

Note to Instructors: In order to effectively implement this lesson, special consideration may have to be given to the scheduling of students enrolled in these courses. For example: The teachers from the disciplines affected need to teach their courses during the same period of the day. Students will be rotated from one discipline to the other with each teacher given a specific time allotted to present the data necessary for the completion of all phases of the project. Teachers involved will decide on the total time to be devoted to the project.

Subject:

Writing business letters

Objectives:

The student will understand the correct form and content of business letters written to request information, to order merchandise, or to register a complaint.

The student will use the forms and conventions of written language appropriately.

The student will proofread written work for punctuation, spelling, grammatical, and syntactical errors.

The student will be able to utilize a word processing software tool to produce the final draft of the letter or letters.

Essential Elements:
Language Arts: 1D, 3G, 3I
Microcomputer Applications: 2A, 2B, 2C

SCANS:

Competencies:
- Resources: A
- Interpersonal: E
- Information: A, B, C, D
- Systems: A
- Technology: A, B

Foundation Skills:
- Basic Skills: A, B
- Thinking Skills: A, B, C, D, E
- Personal Qualities: A, B, C, D, E

Teaching Aids:

Chessboard
Computers

Materials:

Software (word processing)
Transparencies of correct business letter forms
Copies of mail order catalogs and magazines.

References:

Software documentations and available writing resources.

Preparation:

Ask students to relate personal experiences of writing letters of request, order letters, and letters of complaint.

Ask students to relate personal experiences of receiving damaged goods. Explain that writing a letter of complaint is an effective approach to remedy the problem.

Tell students that special content is required in each type of letter that will be studied in this lesson.

Presentation:

As each teacher begins his/her presentation of the unit, the students will be informed that two subject areas, language arts and microcomputer applications, will be involved in this project.

A. Language Arts - The teacher will present the correct form and content of business letters written to request information, to order merchandise, and register a complaint.
   The teacher will monitor group activities of peer editing.

B. Microcomputer Applications - The teacher will train the students on a word processing program.
   Also during this time frame, the teacher will present information covering the proper format of typed business letters.

Application:

A. Letter of Request
   Have students compose a letter to their local fitness center requesting a recommendation for a workout plan.

B. Order Letters
   Using copies of mail order catalogs or magazines that include a mail order section, have students choose items they would like to purchase. Ask students to copy relevant information and compose a letter requesting the desired item.

C. Letters of Complaint
   Have students compose a letter expressing a courteous yet firm complaint to a company that has sent damaged products.

Using the word processor, have the students type these letters using correct form.
Ask students to exchange and edit the letters they have composed in this lesson.
Have students refer to guidelines and models provided by teacher.
Using the word processor, the student will then compose the final draft of letters to turn in to teacher.

Test:

Using the word processor, the student will rewrite scrambled letters to indicate their understanding of correct form and content.
Students may delete extraneous information or invent details to ensure the letter's

clarity and effectiveness.
Students will be able to use the spellcheck and grammar check on the word processing software.

Suggested Extension Activities:

To give students additional practice, have students choose a person in government or a popular cultural figure whose ideas they either support or oppose.

Using a word processor, ask students to write a letter using one of the correct business letter forms.

Integration

Economics
Microcomputer Applications

Note to Instructors: In order to effectively implement this lesson, special consideration may have to be given to the scheduling of students enrolled in these courses. For example: The teachers from the disciplines affected need to teach their courses during the same period of the day. Students will be rotated from one discipline to the other with each teacher given a specific time allotment to present the data necessary for the completion of all phases of the project. Teachers involved will decide on the total time to be devoted to the project.

Subject:

Display of stock market analysis by way of graphs or charts.

Objective:

The student will be able to create a graph(s) using data collected from an analysis of the stock market.

Essential Elements:
Microcomputers EE 5C

SCANS:

Competencies:
Resources: B
Interpersonal: A, B, F
Information: A, B, C, D
Technology: A, B, C

Foundation Skills:
Basic Skills: A, B, C, D
Thinking Skills: B, C, D, E, F
Personal Qualities: A, B, C, D, E

Teaching Aids:

Computers
Overhead projector
Transparencies

Materials:

Software (any kind of graphics program used in the classroom)
newspapers

References:

Software documentation.

Preparation:

As each teacher begins his/her presentation of the unit the students will be informed that two subject areas (economics and microcomputer applications) will be involved with this project.

The overall objective of this lesson plan is to merge the subject areas of economics and microcomputer applications. Students will take the information from the stock market analysis and display the results by way of graphs or charts.

Presentation:

A. Economics. The teacher needs to present a unit on the stock market. Students will be given the task of choosing a business to invest in.

   Each group will "purchase" 100 shares of stock in a business. They are to study the price trends of the stock for a period of one month. At the end of the one month period, students will graph the results of their investment.

B. Microcomputer Applications: During that same time frame, the teacher will train the students on a program that involves graphics. Students will be given business simulations in which various kinds of charts or graphs will be produced.

The following lesson plan will merge the two subject areas. Students will take the information from the stock market analysis and display the results by way of graphs or charts.

Application:

Note to teacher - The application will be based upon the fact that the students have completed a one month's study of the stock market. Students need to have available the results of that study. The application will be assigned to the students after they have completed a rotation of the two discipline areas. It is each teacher's responsibility to cover the material needed for students to successfully complete this assignment. Each teacher will introduce the application and organize student groups in his/her respective class. Teachers will need to organize time schedules in order to allow the various groups to have access to computers.

A. The teacher will revisit the activities covered the last month in both the economics and microcomputer applications classes. The teacher will show how the information derived from the classes can be merged to produce a well defined analysis of the case study.

B. The teacher needs to allow the students to brainstorm various ways in which a graph can be produced. Limitations on the type of graph should not be placed on the students. Also, students should be allowed to produce more than one graph if necessary.

C. In the individual groups, students will problem solve in order to determine an appropriate way to display the results of their study.

D. Students will input the data and produce a hardcopy (or hardcopies) of the results.

Test:

The grade will be based on the finished product(s).

Suggested Extension Activities:

Students may use a word processing software package to develop a report that can be presented in the economics class. Possible topics could include the results of the study, possible causes for a decline or increase in stock prices, or an analysis for net profit or loss.

Integration:

Economics
Microcomputer Application
Language Arts

Note to Instructors: In order to effectively implement this lesson, special consideration may have to be given to the scheduling of students enrolled in these courses. For example: The teachers from the disciplines affected need to teach their courses during the same period of the day. Students will be rotated from one discipline to the next with each teacher given a specific time allotment to present the data necessary for the completion of all phases of the project. Teachers involved will decide on the total time to be devoted to the project.

Subject:

Store Placement: Selecting a location for a music store

Objectives:

The student will be able to analyze the effectiveness of possible locations for the music store.

The student will be able to write a persuasive essay.

The student will be able to utilize various software tools in making the presentation.

Essential Elements:
Economics: 1A, 1E, 1F
Language Arts: 1E
Microcomputer Applications: 2A, 2B, 2C, 4A, 4B, 4C, 4D

SCANS:

Competencies:
- Resources: A, D
- Interpersonal: A, D
- Information: A, B, C, D
- Technology: B

Foundationskills:
- Basic Skills: B, D, E
- Thinking Skills: A, B, C, D, F
- Personal Qualities: C

Teaching Aids:

Chalkboard
Overhead projector
Computers

Materials:

Software (spreadsheet, word processing, and graphics)
Transparencies
Handouts (simulations and "Locating the Business" facts sheet).

References:

Software documentation

Preparation:

As each teacher begins his/her presentation of the unit the students will be informed that three subject areas (language arts, economics, and microcomputer applications) will be involved with this project.

Presentation:

A. Economics—One of the principles students will learn as part of a unit on the market system is freedom of choice. Students will explore a business's choice of location as an application of this principle.

B. Language Arts—Students will be instructed on the elements needed to successfully write a persuasive essay and to make an effective oral presentation.

C. Microcomputers—Students will be instructed on the use of various software application tools in order to create a cost analysis spreadsheet and an outline of the oral presentation.

Application:

Note to teacher—The application will be introduced after students have completed a rotation of the three discipline areas. It is each teacher's responsibility to cover the material needed for students to successfully complete this assignment. Each teacher will introduce the application and organize student groups in his/her respective class.

A. In groups of 3-5, students should brainstorm the ideas of why the location of a business is so important and the ideal features of a successful location. (This activity may best fit into the economics initial presentation.)

B. Presentation of the problem solving activity and a discussion of the "facts" sheet regarding the activity.

C. The teacher will divide the class into groups of four or five and assign specific tasks to each group member. Suggested tasks include: recorder, timer, presenter, and reflective listener.

D. Key points to say or remember:

   1. Carefully read the handout.

   2. Study each site individually.

   3. Allow students to brainstorm considerations including:

      a. cost
      b. customer traffic patterns
      c. size
      d. availability of delivery services
      e. accessibility to mall entrances

E. Have students problem solve and come to a consensus on the location of the business.

F. Create a cost analysis spreadsheet for calculating the rental cost of the site.

G. Pretending your classmates represent a board of directors of a local bank, convince the board to invest in your selected site. Be prepared to defend your selection.

H. Using the word processor, create an outline of the group's main points to turn in to the teacher.

Test:

The grade will be based on the presentation of the group's decision and will include the spreadsheet, outline, and persuasive speaking.

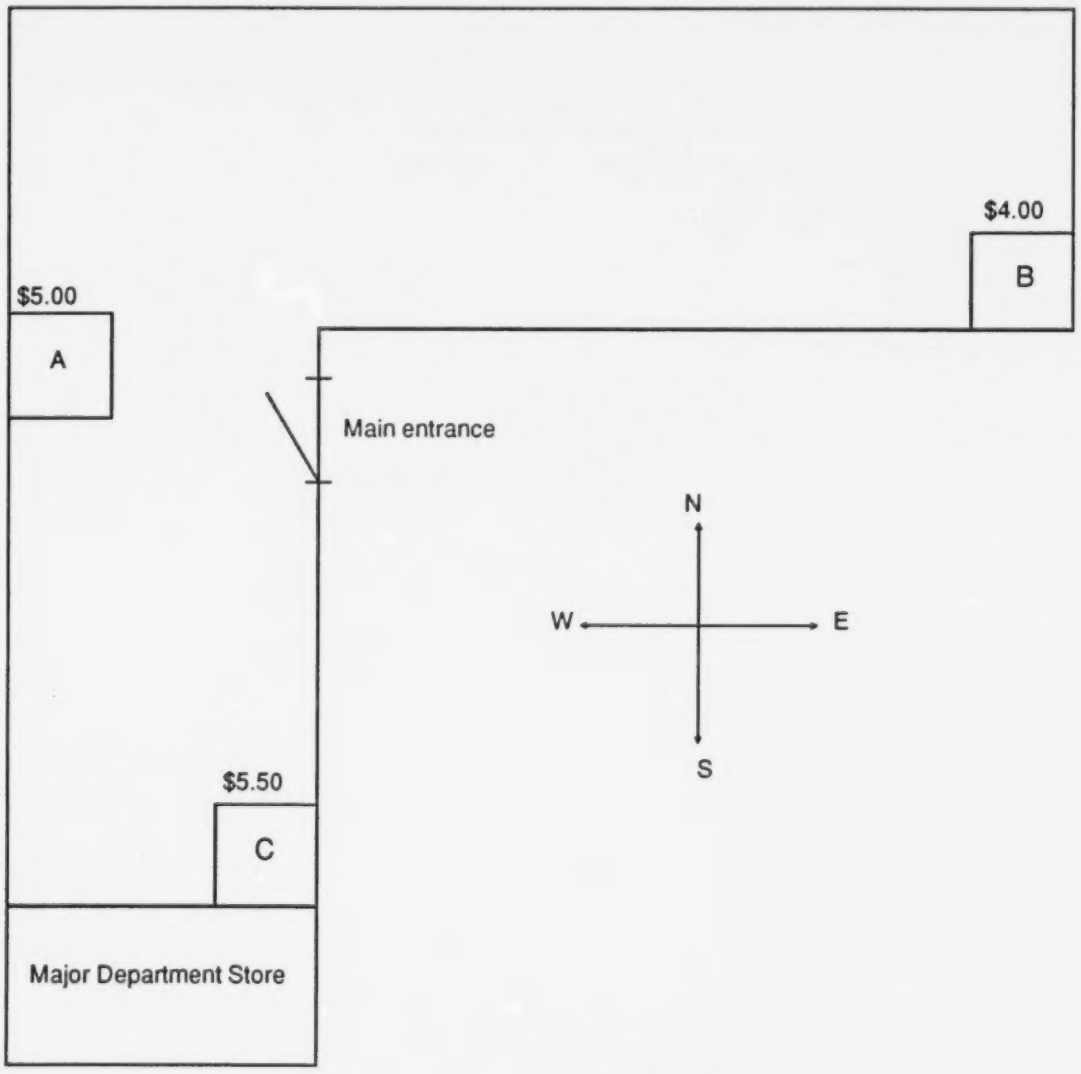
Suggested Extension Activities:

A. Include actual case studies of various businesses in the area.

B. Guest speakers.

Locating A Business Facts Sheet:

Barton Creek Mall has several retail spaces available for rent. You will lease an area twenty feet by twenty five feet and will pay for it by the square foot. The price of the floor space will depend on the location of the mall. Area "A" has showcase windows on the front and back walls for effective display of products. Area "B" is located in the southeast corner of the mall. The cost per square foot reflects the distance from main entrance. Area "C" adjoins a major department store in the mall. The major department store serves customers of all socioeconomic categories.



Integration:

Government,
Language Arts
Microcomputer Applications

Note to Instructors: In order to effectively implement this lesson, special consideration may have to be given to the scheduling of students enrolled in these courses. For example: The teachers from the disciplines affected need to teach their courses during the same period of the day. Students will be rotated from one discipline to the other with each teacher given a specific time allotment to present the data necessary for the completion of all phases of the project. Teachers involved will decide on the total time to be devoted to the project.

Subject:

Producing effective persuasive communication for a political campaign

Objectives:

The student will be able to use propaganda techniques to build an effective campaign platform. (EE 4A)

The student will be able to create a campaign flyer using a desktop publishing software package. (EE5C)

The student will be able to write a persuasive discourse. (EE 1E)

The student will be able to evaluate content, organization, topic development, appropriate transition, clarity of language, appropriate word and sentence choice according to the purpose and audience for which the composition is intended. (EE 1G)

The student will be able to use oral language effectively. (EE 2D)

The student will be able to use a word processing software package to produce a hard copy of the persuasive speech. (EE 2B, 2C)

Essential Elements:
Government: 4A
Language Arts: 1E, 1G, 2D
Microcomputer Applications: 2B, 2C, 5C

SCANS

Competencies:
- Interpersonal: D, F
- Information: C, D
- Systems: A
- Technology: A

Foundation Skills:
- Basic Skills: A, B, E
- Thinking Skills: A, D
- Personal Qualities: A, B, E

Teaching Aids:

Computers
Overhead projector
Transparencies

Materials: Software (any kind of desktop publishing and word processing software package used in the classroom)
Newspapers (if appropriate)
Sample campaign flyers

Preparation:
As each teacher begins his/her presentation of the unit the students will be informed that three subject areas (government, microcomputer applications, and language arts) will be involved with this project.

Presentation:

A. Government - As part of a unit on political behavior, students will learn the techniques commonly used in political propaganda.

B. Microcomputer Applications - The office education teacher will train the students on a desktop publishing program. Time will also be needed to introduce or review essential word processing software steps to produce a hard copy of the speech.

C. Language Arts - The language arts teacher will teach the styles of effective persuasive discourse.
The following lesson plan will merge the three subject areas. Students will take the information from the government, language arts and microcomputer application classes and merge them to produce a campaign flyer and persuasive campaign speech.

Application:

A. The students will receive an explanation of the overall goals and objectives of this project from each of the teachers involved in the project.

B. In the language arts class, students will begin composing a persuasive speech to run for the office of their choice.

C. In the government class, students will see examples of campaign flyers and will choose appropriate propaganda techniques.

D. In the microcomputer class, students will, with the use of a desktop publishing software package, create a campaign flyer utilizing platform ideas developed in the language arts and government classes. Students will also utilize a word processing software package to print out their campaign speeches.

E. Flyers will be displayed in a central location. Students will vote on the most persuasive and creative flyers.

F. The students whose flyers receive the most votes will present their speeches to a general session of all of the students involved in the project. (The teacher will determine the number of speeches to be given.)

Test:
The grade will be based on the finished product.